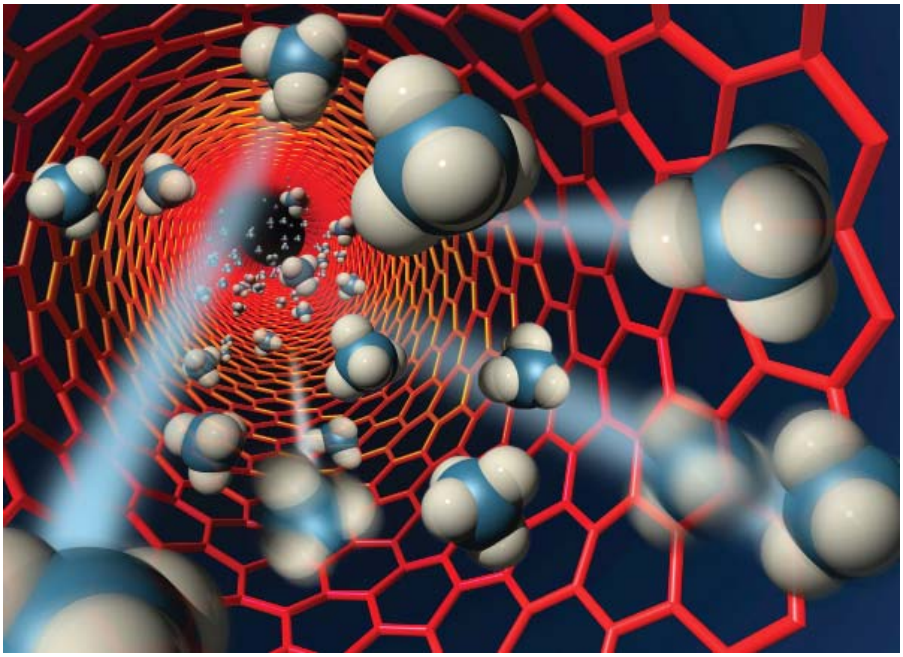
National Aeronautics and Space Administration

technology opportunity

Application of Carbon Nanotube Hold-off Voltage for Determining Gas Composition

Methods and system for determining chemical composition of a single-component or multiple-component gas, using a discharge holdoff mechanism.



Methods and system for determining chemical composition of a single-component or multiple component gas, using a discharge holdoff mechanism.

Few sensors are available to detect inert gases. Conventional inert gas analysis tools primarily rely upon infrared (IR) spectroscopy, mass spectroscopy (MS) and/or thermal conductivity measurements. Thermal conductivity sensors are available for fixed and portable instruments, but this technique is not suitable for measuring extremely low levels of a gas (e.g., less than 1 percent by volume resolution), and the technique has difficulties when the target gas has a thermal conductivity close to that of a background gas. For example, measurement of oxygen in air is not feasible, because the two gases have essentially the same thermal conductivity.

Technology in Detail

IR spectroscopy is often used to measure carbon dioxide in air, or methane in carbon dioxide, as found in sewage digestor and coal gasification plants. This technique is superior to thermal conductivity sensing in accuracy and resolution, but use of IR is more expensive due to the complex optics and signal processing required. A MS-based sensor can be used to detect pressure of an inert gas, but this technique is expensive and heavy and time consuming and is not suitable for in situ measurements. Fourier transform IR and MS techniques require bulky, heavy instruments and/or high temperature operation, and consumption of electrical power is very large.

A voltage pulse discharge approach may provide a reasonable estimate of a threshold voltage for which discharge first occurs, and thus provide an estimate, by means of exclusion of most others, of a gas component having the smallest threshold discharge voltage. In practice, many workers do not distinguish between a discharge in a gas component that occurs instantaneously and a discharge in the same gas component that occurs only after a modest time delay (e.g., 5-30 sec) for what appears to be the same discharge. However, in some materials, the time delay decreases monotonically with increase in the pulse voltage so that the so-called discharge voltage may be ambiguous.

The solution is a relatively lightweight and small sensor for inert gas components that consumes a relatively small amount of power that provides measurements that are as accurate as the conventional approaches, and that distinguishes between a gas component discharge that occurs substantially instantaneously and a discharge in the same gas component that occurs after a substantial time delay. Preferably, this sensor should be able to detect and identify presence of one, two or more gas components, some or all of which may be relatively inert (e.g., Ne, Ar, Xe, Kr, CO, etc.), and to provide an estimate of concentration of at least one gas component

Patents

This technology has been patented (U.S. Patent 7,623,972).

Licensing and Partnering Opportunities

This technology is part of NASA's Innovative Partnerships Program, which seeks to transfer technology into and out of NASA to benefit the space program and U.S. industry. NASA invites companies to inquire about licensing possibilities for this technology for commercial applications.

For More Information

If you would like more information about this technology, please contact:

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